

REMARKS

Claims 1 and 2 have been amended, Claims 11, 12, 24 and 25 have been withdrawn from consideration as being directed to a non-elected invention. Thus, claims 1-25 are pending in the present application, with claims 1-10 and 13-23 currently under consideration. Although claims 11, 12, 24 and 25 are directed to a non-elected invention, inasmuch as these claims are all ultimately dependent on the elected claims, rejoinder of the claims will be proper upon allowance of the elected claims. Support for the amendment to claim 1 may be found in original claim 2. Thus, the present amendments do not add new matter and entry thereof is respectfully requested.

Obviousness-type double patenting

Claims 1-10 and 13-23 were rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1-10 of commonly owned U.S. Patent No. 7,402,372.

Claims 1-10 and 13-23 were provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1-9 and 12-20 of commonly owned copending Application No. 10/540,056.

Enclosed herewith is a terminal disclaimer, thus overcoming these rejections.

Rejection under 35 U.S.C. § 103(a)

Claims 1-10 and 13-23 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Uetani et al. (US 6,627,381) in view of Nakanishi et al. (US 2002/0164540), Suzuki et al. (US 6,899,989) and Hatakeyama et al. (US 6,660,447). The Examiner alleges that it would have been *prima facie* obvious to use a copolymer having a weight average molecular weight between 5,000 and 8,500 in view of Nakanishi et al. and having a polydispersity of 1-3 based on the disclosed degree of dispersion in Nakanishi et al., with more than one photoacid generator as suggested by Suzuki et al. and Hatakeyama et al. and reasonably expect same or similar results as recited in Uetani et al. for a photoresist composition which is excellent in sensitivity, resolution and dry etch resistance. However, as explained below, this combination of references does not render the presently claimed invention obvious.

No Prima Facie Showing of Obviousness

Claims 1-10

Uetani et al. (US 6,627,381) discloses a copolymer which has a hydroxystyrene-based polymerization unit and a 3-hydroxy-1-adamantyl methacrylate-based polymerization unit as essential units. However, Uetani et al. does not disclose that a weight average molecular weight of the above copolymer prior to protection with a protective group is within the range of 2,000 to 8,500 as recited in present claim 1. In fact, the weight average molecular weight of a copolymer used in the Example of Uetani et al. is 9,800 which is not within the range recited in present claim 1. In addition, Uetani et al. does not disclose using the combination of the diazomethane-based acid generator and the onium salt-based acid generator as recited in present claim 1.

Nakanishi et al. (US 2002/0164540) discloses a copolymer of 2-ethyl-2-adamantyl methacrylate and p-hydroxystyrene which has a weight-average molecular weight of 8200. Uetani et al. disclose "the copolymer which has the hydroxystyrene-based polymerization unit and the 3-hydroxy-1-adamantyl methacrylate-based polymerization unit as essential units", which is quite different from the above copolymer of Nakanishi et al. Furthermore, Nakanishi et al. does not disclose the 3-hydroxy-1-adamantyl methacrylate-based polymerization unit.

Suzuki et al. (US 6,899,989) discloses a combination of a resin comprising recurring units represented by formula (2) and (3), and a mixture of photoacid generators. Hatakeyama et al. (US 6,660,447) discloses a combination of a polymer comprising recurring unit represented by formula (1) and a mixture of photoacid generators. However, the resins of Suzuki et al. and Hatakeyama et al. are quite different from the resin of Uetani et al. Although Uetani et al. disclose "the copolymer which has the hydroxystyrene-based polymerization unit and the 3-hydroxy-1-adamantyl methacrylate-based polymerization unit as essential units", Suzuki et al. and Hatakeyama et al. do not disclose that the resin contains a 3-hydroxy-1-adamantyl methacrylate-based polymerization unit.

The effectiveness of different photoacid generators for different resins is known to vary considerably. Therefore, since the resins of Suzuki et al., Nakanishi et al. and Hatakeyama et al. are clearly quite different from the resin of Uetani et al. As such, one of ordinary skill in the art would have no reasonable expectation of success in using the mixture of photoacid generators of Suzuki et al. and Hatakeyama et al. in connection with the resin of Uetani et al. Without such a

reasonable expectation of success, the references do not constitute a proper *prima facie* showing of obviousness with regard to Claim 1, or Claims 2-20, which depend therefrom.

Claims 13 to 23

Uetani et al. discloses a copolymer comprising a hydroxystyrene-based polymerization unit and a 3-hydroxy-1-adamantyl methacrylate-based polymerization unit. However, Uetani et al. does not disclose use of the component (C) recited in present claim 13. In addition, none of the other cited references disclose component (C). Thus, since this claim element is missing from all of the cited references, claim 13, and claims 14-23 which depend either directly or indirectly on claim 13, cannot be *prima facie* obvious.

Unexpected results

Moreover, even had a proper *prima facie* showing of obviousness been set forth, the presently claimed invention provides significant unexpected results that would effectively rebut any such showing.

Claims 1-10

Claims 1-10 relate to a positive resist composition capable of producing a resist pattern with excellent resolution and favorable rectangularity, and a method of forming a pattern that uses such positive resist compositions. In order to achieve such beneficial properties, Claim 1 includes the following characteristics:

- (1) A positive resist composition, comprising a resin component (A), which contains acid dissociable, dissolution inhibiting groups and exhibits increased alkali solubility under action of acid, and an acid generator component (B) that generates acid on exposure, wherein
- (2) said resin component (A) is a copolymer (A1) comprising a first structural unit (a1) derived from hydroxystyrene and a second structural unit (a2) derived from a (meth)acrylate ester having an alcoholic hydroxyl group, in which
- (3) a portion of hydroxyl groups of said structural units (a1) and alcoholic hydroxyl groups of said structural units (a2) have been protected with said acid dissociable, dissolution inhibiting groups, and
- (4) a weight average molecular weight of said copolymer (A1) prior to protection with said acid dissociable, dissolution inhibiting groups is at least 2,000 but no more than 8,500, and

(5) said acid generator component (B) comprises a diazomethane-based acid generator and an onium salt-based acid generator.

Copolymer (A1) contains the structural unit (a1) and (a2) as structural units. In particular, the copolymer (A1) contains a structural unit (a2) that is capable of introducing alcoholic hydroxyl groups, which exhibit lower alkali solubility compared to phenolic hydroxyl groups, into a portion of the base resin side chains instead of the above hydroxystyrene units. As a result, the solubility of the copolymer (A1) in alkali developing solutions is less than that of polyhydroxystyrene resins. Thus, the protection ratio can be lowered, the level of defects can be reduced, and the resolution can be improved (see present specification at page 8, lines 6-19).

In addition, the above characteristic (4) recites that the weight average molecular weight of the copolymer (A1) prior to protection with the acid dissociable, dissolution inhibiting groups is within the range of 2,000 to 8,500. Provided this weight average molecular weight is no more than 8,500, the rectangularity of the resist pattern can be improved and generation of microbridges can also be prevented. If the weight average molecular weight is at least 2,000, the etching resistance and the heat resistance are favorable. The term "microbridge" describes a type of developing defect, where in a line and space pattern, for example, portions of adjacent resist patterns near the surface of the pattern are linked together via a portion of resist, generating a bridge-like defect. Microbridges are increasingly likely for higher weight average molecular weight values, and for higher temperatures within post exposure baking (PEB) (see present specification, page 14, lines 4-13).

Moreover, present Claim 1 recites that as the component (B), a combination of the diazomethane-based acid generator and the onium salt-based acid generator is used. By combining the component (A) described above with this acid generator mixture, a resist pattern that exhibits high resolution and favorable rectangularity can be formed (see present specification at page 15, lines 16-20).

Example 1 of the present specification combining component (A) with the acid generator mixture described above discloses that the cross-sectional shape of the resist pattern was very favorable, with a high degree of rectangularity. Reference Example 1 of the present application uses only the diazomethane-based acid generator as component (B) without the recited an onium salt-based acid generator. The results of this Reference Example show that the rectangularity of

the pattern was poor, with the top portions of the pattern a rounded shape. Thus, it is clear that the recited component (B) provides unexpected advantages.

The unexpected advantages of the claimed resist compositions discussed above are neither disclosed nor suggested by any of the cited references alone or in combination, and could not have been predicted based on these references. These unexpected results would effectively rebut any alleged case of *prima facie* obviousness, and strongly support the nonobviousness of Claims 1-10.

Claims 13-23

Present Claims 13-23 relate to a positive resist composition that is resistant to the development of developing defects while retaining excellent resolution. In order to achieve such beneficial properties, Claim 13 includes the following characteristics:

- (1) A positive resist composition, comprising a resin component (A), which contains acid dissociable, dissolution inhibiting groups and exhibits increased alkali solubility under action of acid, and an acid generator component (B) that generates acid on exposure, wherein
- (2) said resin component (A) is a copolymer (A1) comprising a first structural unit (a1) derived from hydroxystyrene and a second structural unit (a2) derived from a (meth)acrylate ester having an alcoholic hydroxyl group, in which
- (3) a portion of hydroxyl groups of said structural units (a1) and alcoholic hydroxyl groups of said structural units (a2) have been protected with said acid dissociable, dissolution inhibiting groups, and
- (4) said composition further comprises a compound (C), which contains at least one acid dissociable, dissolution inhibiting group, and which under action of acid generated from said component (B), undergoes dissociation of said dissolution inhibiting group, generating an organic carboxylic acid.

By including component (C), developing defects, such as developing residues, can be suppressed while a favorable level of resolution is retained. As a result, very fine resist patterns can be resolved (see present specification at page 23, lines 10-12).

Example 4 of the present application, which uses component (C) and a copolymer containing structural units (a1) and (a2), demonstrates that a 120 nm line and space pattern was resolved, and that there were no developing defects such as developing residues.

Reference Example 3 of the present application shows results when an experiment was conducted in the same manner as example 4, but without adding component (C). When the

resulting pattern was evaluated, a 130 nm line and space pattern was resolved. However, developing residues existed within the resist pattern, with fine uneven developing defects noticeable, particularly at the interfaces between the lines and spaces. Thus, the direct comparison provided between Example 4 and Reference Example 3 shows that the addition of component (C), as presently claimed, unexpectedly reduces developing defects within the resist pattern. The unexpected results obtained when including component (C) clearly evidence the nonobviousness of the presently claimed invention.

These unexpected advantages of the claimed resist compositions are neither disclosed nor suggested by any of the cited references alone or in combination, and could not have been predicted based on these references. Accordingly, these unexpected results would effectively rebut any alleged case of *prima facie* obviousness, and strongly support the nonobviousness of the claims, including Claims 13-23.

In view of the comments presented above, Applicants respectfully request reconsideration and withdrawal of the rejection under 35 U.S.C. § 103(a).

CONCLUSION

In view of the foregoing, Applicant submits that all claims are in condition for allowance. However, if minor matters remain, the Examiner is invited to contact the undersigned at the telephone number provided below. Please charge any additional fees, including any fees for additional extension of time, or credit overpayment to Deposit Account No. 11-1410.

Respectfully submitted,

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Dated: 12/4/08

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